

June 22, 1937.

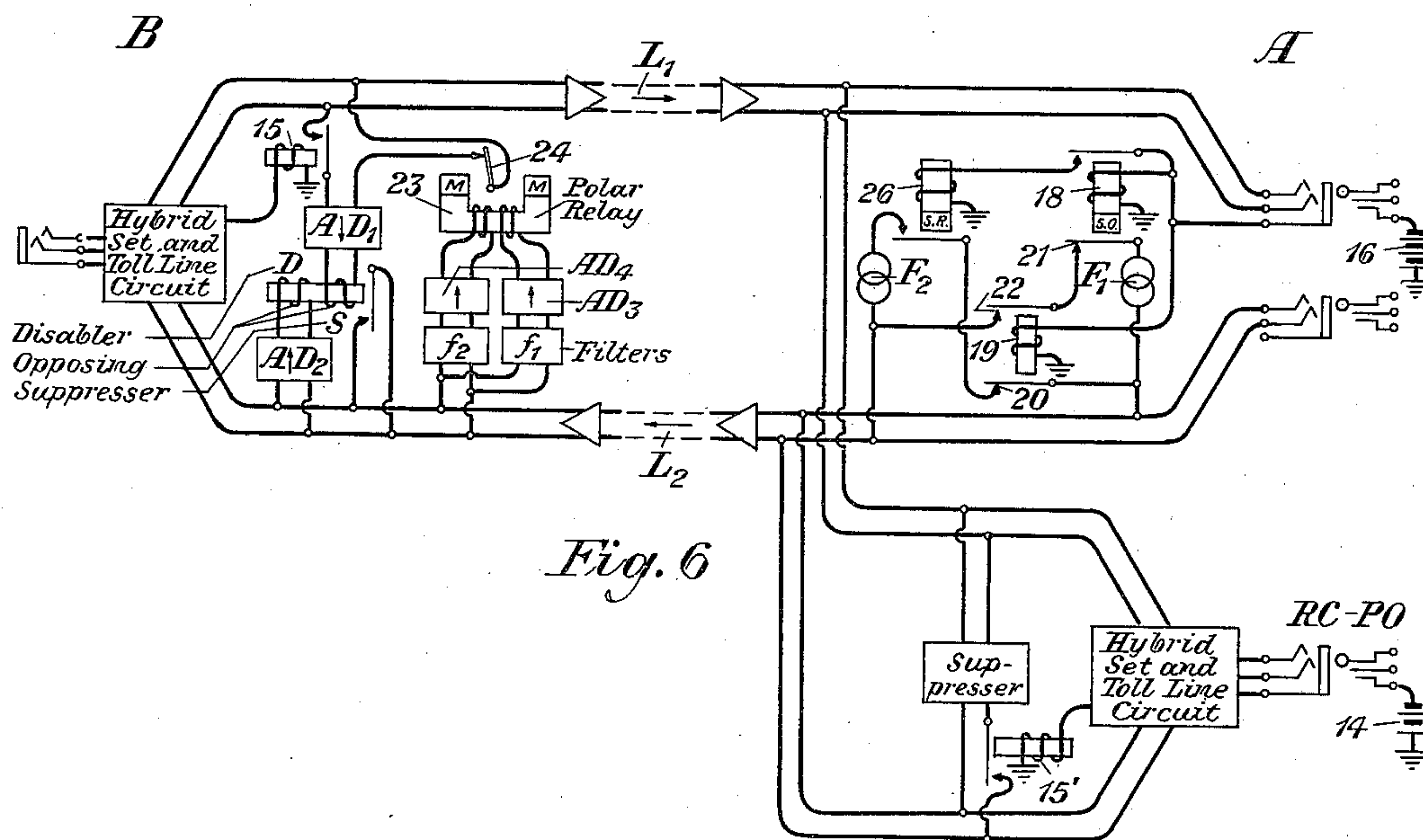
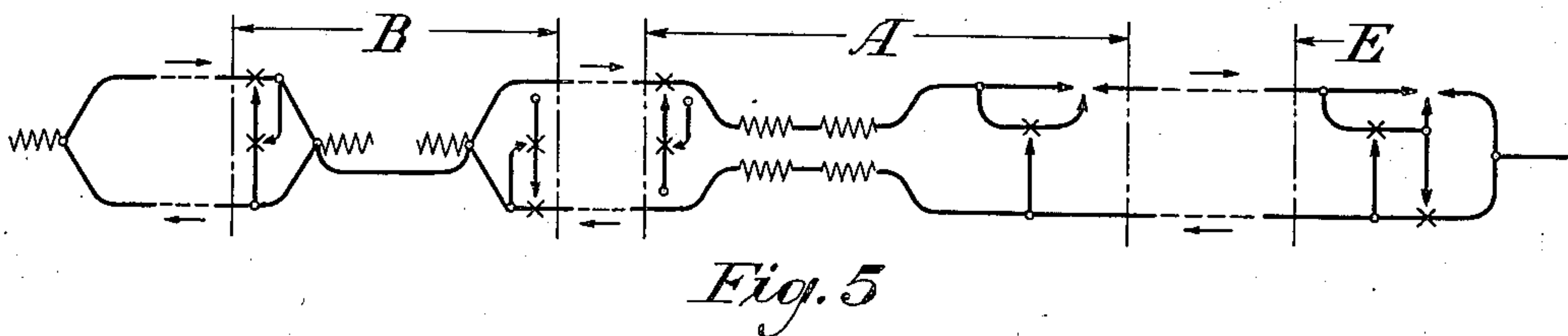
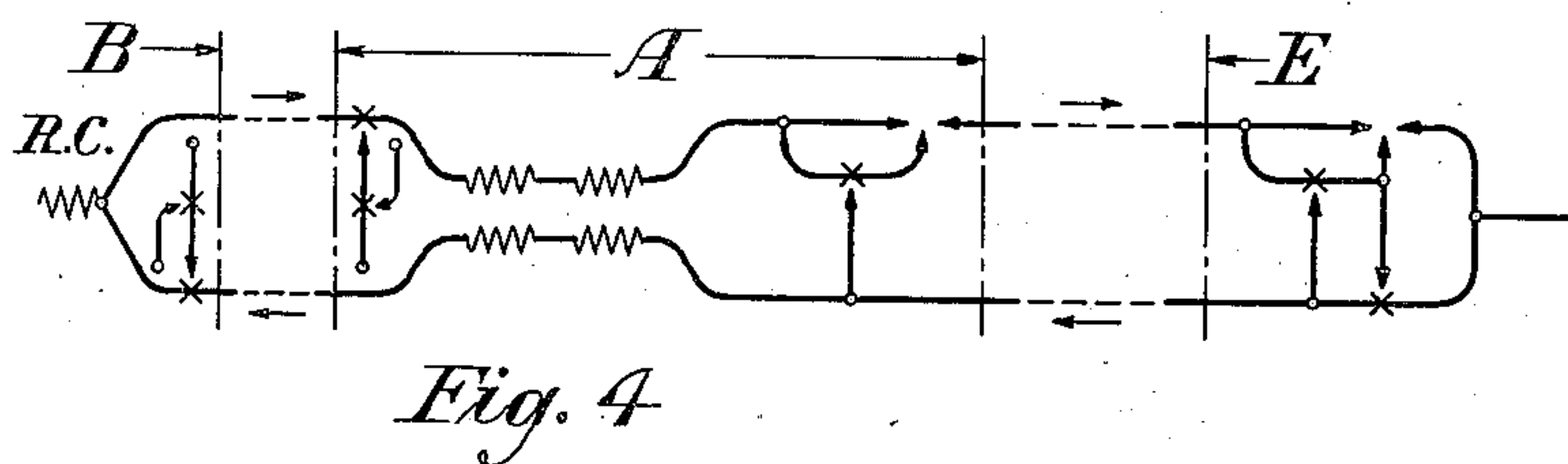
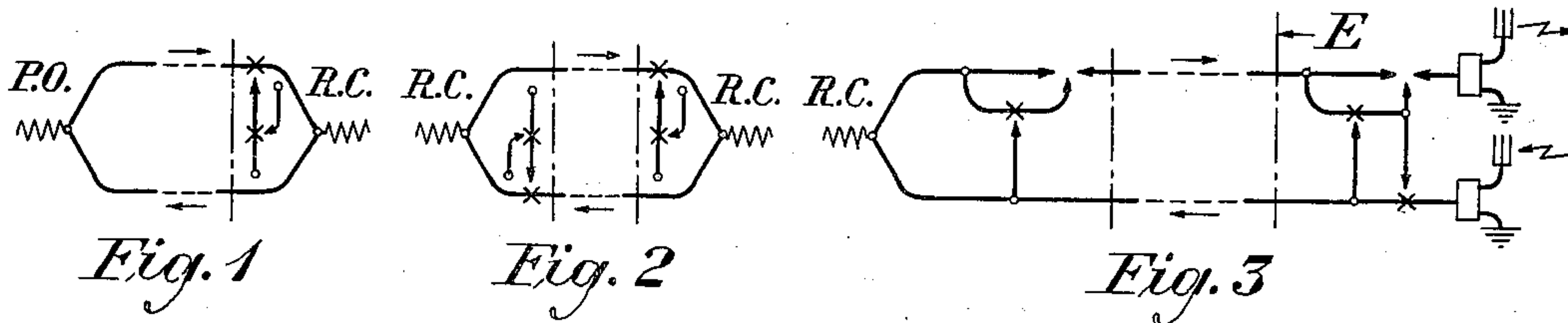
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2,084,422

TELEPHONE TRANSMISSION CIRCUIT

Filed July 6, 1936

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

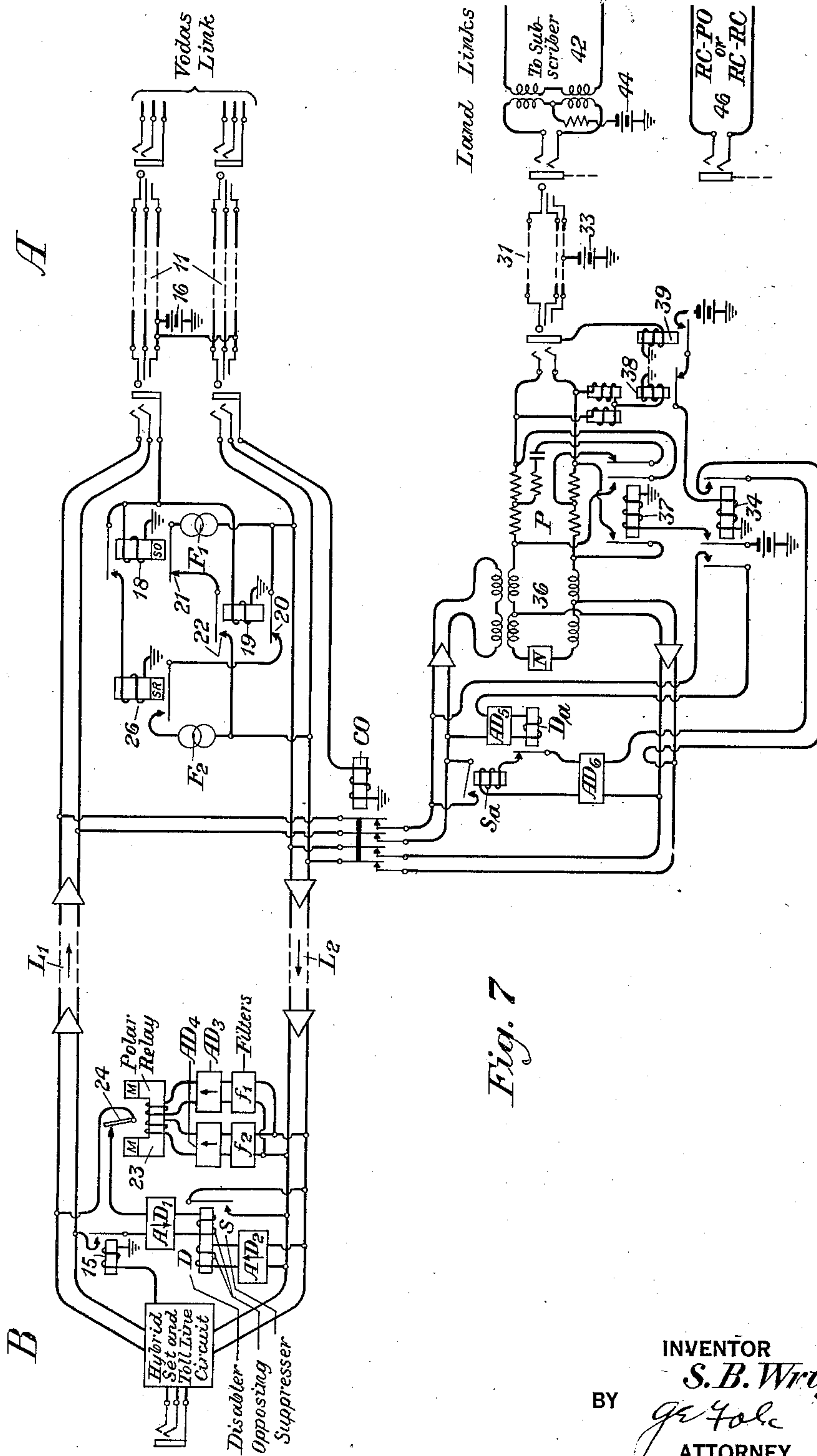


Fig. 7

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2,084,422

TELEPHONE TRANSMISSION CIRCUIT

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Application July 6, 1936, Serial No. 89,213

19 Claims. (Cl. 179—170)

This invention relates to telephone transmission circuits, and more particularly to a circuit in which a plurality of telephone links equipped with echo suppressors or related devices are to be connected in tandem. One of the links may be a radio or a cable link such as is, or may be, used for transatlantic communication and which will be supplied with devices called vodases, for certain purposes to be explained hereafter.

10 The object of the invention is to limit the lockout to a minimum when a plurality of links including the radio or cable link is connected, and more particularly to provide an arrangement for connecting such a radio or cable link to long distance wire circuits in such a way that the echo suppressors on the wire circuits do not increase the lockout interval or zone beyond the value obtained on a call over the cable circuit alone.

20 In the circuit involving my invention use is made of a system of transmitting terminal echo suppressors located only at important switching points, such as regional centers, as described in my copending application Serial No. 748,765, filed October 17, 1934. As described in that application, the echo suppressors are disabled except when more than one link are involved in a connection. The act of connecting together two or more links automatically places the echo suppressors in connection at the regional centers.

30 The broad scheme of connections for long distance telephonic purposes on circuits in such a country as the United States is described in an article on General Switching Plan for Telephone Toll Service, by Osborne, published in the Bell System Technical Journal, July, 1930. In my copending application and in the article mentioned, reference is made to RC—RC links extending between a few important switching points in this country, the terminations of these links being at so-called regional centers. Reference is also made to PO—RC links which fan out from regional centers to other slightly less important switching points, called primary out-lets or toll centers. Both of these links are normally operated on a four-wire basis and may be connected at the switching point on either a two wire or a four-wire basis. In addition, consideration is to be given to another type of link, such as that illustrated by the present trans-Atlantic radio link, or by a corresponding long cable, permanently connected to a portion of four-wire circuit. This latter type is subject to much greater operating difficulties and, consequently, it is the usual practice to have the chan-

nel of such a link in one direction normally disabled through one or more devices called a "vodas", this term being an abbreviation for "voice-operated device anti-singing." It is well illustrated in patent to Crisson et al., No. 1,837,316, December 22, 1931.

The present application is a continuation in part of my copending application, Serial No. 748,766, filed October 17, 1934.

The invention will be better understood by reference to the following specification and the accompanying drawings in which Figures 1, 2 and 3 are conventionalized representations of the three types of links mentioned above; Fig. 4 shows the connection of an RC—RC link with a vodas link; Fig. 5 shows the circuit of Fig. 4 extended by connection to a PO—RC link; Fig. 6 shows some of the details by which the purpose of the invention is carried out, and Fig. 7 shows further details by which the purpose of the invention is carried out.

The first two types of links, as shown diagrammatically in Figs. 1 and 2, are equipped with echo suppressors which are normally disconnected but which may be connected into circuit for the purpose and in the manner described in my copending application, Serial No. 748,765. In that application, also, a description is given of a new type of suppressor, which I call the transmitting suppressor in that a suppressor is operated by speech when the speech first arrives on the link and is about to be transmitted over the link. The link of Fig. 2 may be used without connection to other RC—RC links or PO—RC links, and in that case, according to the invention of said copending application, the suppressors will not in general be connected. This is feasible either because the RC—RC link may be relatively short, or because it is a high speed line, such as an unloaded cable circuit. In the event, however, of the connection of such links, arrangement is made for the introduction or connection of the transmitting terminal suppressors at the regional centers, this being accomplished through relays operated on the introduction of the cord circuit connecting the two links, and the connection of two such links does not permit opportunity for lockout. If, however, more than two links are connected, then a certain amount of lockout will occur over one or more of the RC—RC links.

It is the purpose of this invention to provide arrangements by which when connection is made to a vodas link, the echo suppressors on the RC—RC links are prevented from being con-

connected, this for the purpose of preventing the increase of lockout zone due to such an RC—RC link. I accomplish this by having a tone signal sent from station A to the other regional center whenever the special cable or radio connection is put up. This tone operates a disabling circuit to disable the remote suppressor. At the completion of the call another tone signal is sent out to place the suppressor in commission for other calls that may go through the distant regional center.

Fig. 4 shows the connection of an RC—RC link to the vodas link at a regional center or switching point A. The connection is made on a four-wire basis, in a manner to be described later, and so arranged that upon connection the terminal suppressors on the RC—RC link at the switching points A and B are left disconnected, the vodas relays on the vodas link being left connected so as to operate in the normal manner. Under these circumstances, it is seen that there is no increase in the lockout zone over that which is present in the cable or radio portion of the vodas link. Fig. 5 shows the extension of the circuit of Fig. 4 to include a PO—RC link, and with the normal cord circuit arrangement described in my copending application, Serial No. 748,765, the terminal suppressors at switching point B would be introduced both on the RC—RC terminal and the PO—RC terminal. This would increase the lockout zone to the extent of including the RC—RC link which might be as much as several thousand miles long. To prevent this, I provide, according to this invention, means associated with the cord circuit at regional center A which will disable the suppressor on the RC—RC link at regional center B, the details for this being shown in Figs. 6 and 7, in which L_1 and L_2 are the opposite sides of a repeated four-wire circuit.

The arrangement shown in Fig. 7 is fundamentally the same as that shown in Fig. 6, the cut-off relay CO being shown and the suppressor and normal toll line circuit being shown more in detail. The suppressor and normal toll line circuit is substantially the same as that shown in Fig. 11 of my copending application, Serial No. 748,765. The details of the invention will be described in connection with Fig. 7. The terminal of the RC—RC link which is to be connected to the vodas link is shown at the upper right-hand part of the figure as terminating at station A. For simplicity, the terminal suppressor which would be at the A end of this link is here shown offset in parallel below the cut-off relay CO which is operated by battery 16 over the sleeve of the lower jack of the terminal so as to disconnect the normal toll line circuit and echo suppressor at station A whenever the vodas link is connected. Upon connection, however, of the PO—RC link at station B, either on a four-wire or a two-wire basis, the suppressor on the RC—RC link at the station B would be connected into circuit through the cord circuit connection at that station operating on the relay 15. This is a connection which is required in the event that the RC—RC link at its right end were to be connected to another RC—RC or RC—PO link, but it is desired to disable this suppressor in the event that switching is made to the vodas link. To this end there are installed at the station A two generators F_1 and F_2 of frequency f_1 and f_2 , one of which may, at the appropriate time, be connected to send a spurt of alternating current over the transmission line to apparatus which will disable the suppressor at the other end of the link and the other to send

a spurt of different frequency to put the suppressor back in commission under control of relay 15. Battery 16 is connected through the upper sleeve of the cord circuit 11 at station A to relays 18 and 19 in parallel. The relay 19 is a reasonably fast-operating relay and, when operated, will at contact 22 connect the generator F_1 of frequency f_1 across the transmission line. Alternating current of this frequency will then be transmitted until the circuit for this generator is broken at the point 21 by the relay 18, which is a slow-operate relay. This spurt of current, which is selected at station B by the filter passing frequency f_1 , will then operate the polar relay 23 through the amplifier-detector AD₃ to open the contact at 24, thus disabling the suppressor. The operation of the relay 18 will also close the circuit for the slow-release relay 26, which would operate and would place the generator F_2 of frequency f_2 across the line except for the fact that its circuit is broken at 20 on the operation of relay 19. Upon disconnecting the cord circuit 11, relay 19 quickly releases, thus opening the circuit of generator F_1 at a second point and closing at 20 the circuit for generator F_2 of frequency f_2 until the relay 26 releases. The corresponding spurt of alternating current of frequency f_2 passing over the transmission line is transmitted through filter of frequency f_2 and amplifier-detector AD₄ to again operate the polar relay 23, which, in this case, closes the contact at 24 thus returning the echo suppressor to the circuit at station B.

In case the cord circuit connection at A is from the RC—RC link to another RC—RC link or to an RC—PO link, the circuit containing the generators F_1 and F_2 is not brought into operation. This may be accomplished simply by providing another cord circuit with battery 16 connected only to the lower sleeve thereof or by using a battery of different potential in the other cord circuit and making relays 18, 19 and 26 marginal so that they will not operate on this new potential. On the other hand, these results may be accomplished as shown in the lower right-hand portion of Fig. 7, where a terminal for the RC—RC link appropriate for connection to another RC—RC link, an RC—PO link or a subscriber circuit is shown connected in parallel through the contacts of cut-off relay CO to the terminal already described. If cord circuit 11 is not connected, cut-off relay CO will not be operated and the lower terminal which includes the echo suppressor is available to cord circuit 31. In this arrangement, which is described in my copending application, Serial No. 748,765, the four-wire link is brought to a two-wire basis through the hybrid set 36, and the echo suppressor is made available but is normally disconnected at the outer contacts of relay 34. On setting up cord circuit 31 for connection to RC—RC or RC—PO link 46, battery 33 acts through the sleeve connection to introduce the echo suppressor. When a connection is made to subscriber circuit 42, battery 44 operates relay 38 to prevent the introduction of the echo suppressor. Also, as disclosed in said copending application, the lower terminal may be connected to the RC—RC or RC—PO link on a four-wire basis if desired.

From the above, it is seen that through this invention I have provided means whereby when an RC—RC link is connected to another RC—RC or an RC—PO link, the terminal suppressors are connected as described in my copending application, Serial No. 748,765, but means also whereby if the connection is to a link containing vodases,

the near terminal suppressor of the RC—RC link is left disconnected and the terminal suppressor at the remote end which would normally be put into action on the extension of the circuit into an RC—PO link is disabled by the act of putting up a cord circuit at the point where the RC—RC link is connected to the vodas link. Furthermore, when this cord circuit is taken down, the terminal suppressor at the remote end is automatically enabled. Incidentally, it should be noted that the putting up of the cord circuit at B connects in the terminal suppressor at the regional center end of the PO—RC link. This is not only permissible but desirable to prevent echo return from the PO end of the link and its introduction does not add to the lockout for the reason that it is not operated by speech traveling in the direction toward the vodas link.

In this specification, frequent reference has been made to four-wire circuits. This is a convenient term to use but it is to be understood that so far as this invention is concerned, it may mean either two pairs of physical wires or it may mean a single pair of wires using two separate channels, one in one direction and the other in the other direction.

What is claimed is:

1. In a communication system comprising several links, one link being a normally disabled link containing a vodas, two or more links being adapted to be connected in series, the method of limiting lockout to a portion of the vodas link which consists in supplying terminal transmitting echo suppressors to one end of PO—RC links and each end of RC—RC links to be connected, leaving these normally disconnected, connecting these at switching points when connection of links including the vodas link is made, and disabling the suppressors on the RC—RC links when switching connection is made to the vodas link.

2. In a communication system comprising several links, one link being a normally disabled link containing a vodas and a portion of which is a two-way one channel transmission path, the method of limiting lockout to the two-way one channel portion which consists in supplying terminal transmitting echo suppressors to one end of the PO—RC links and each end of the RC—RC links to be connected, leaving these normally disconnected, connecting these at switching points when connection of links involving the two-way one channel portion is made and disabling the suppressors on the RC—RC links when switching connection is made to the vodas link.

3. In a communication system comprising several RC—RC links and one link containing a vodas, two or more of these links being adapted to be connected in series, the method of limiting lockout to the vodas link which consists in supplying terminal transmitting echo suppressors to each end of the RC—RC links to be connected, leaving these normally disconnected, connecting these at the switching points when connection of links including the vodas link is made, and leaving the near suppressor in the link which is adjacent the vodas link disabled and disabling the more remote suppressor in that link.

4. In a system comprising several four-wire links and an intermediate two-wire link and a vodas portion adjacent each end of the two-wire link, the remaining four-wire links being equipped with single terminal echo suppressors, means for limiting lockout to the two-wire link when several links are connected in series, comprising means for normally leaving the suppressors dis-

connected and for connecting them as transmitting suppressors at any switching point on connection of two links at that point, and means for leaving that suppressor adjacent the link with vodases disabled when connection to that link is made.

5. The combination of claim 4 characterized by the fact that there are near and remote suppressors in the link adjacent the vodas link and that there are additional means for disconnecting transmitting echo suppressors more remote from the vodas link.

6. In a system comprising several links operating on a two-channel basis and an intermediate two-way single channel portion, and a vodas portion adjacent each end of the single channel portion and constituting a vodas link, the remaining two channel links being equipped with single terminal echo suppressors, means for limiting lockout to the single channel portion when several links are connected in series, comprising means for normally leaving the suppressors disconnected and for connecting them as transmitting suppressors at any switching point on connection of two links at that point, and means for leaving that suppressor adjacent that link with vodases disabled when connection to that link is made.

7. In a system comprising several links operating on a two-channel basis and an intermediate two-way single channel portion, and a vodas portion adjacent each end of the single channel portion and constituting a vodas link, the remaining two channel links being equipped with single terminal echo suppressors, means for limiting lockout to the single channel portion when several links are connected in series, comprising means for normally leaving the suppressors disconnected and for connecting them as transmitting suppressors at any switching point on connection of two links at that point, means for leaving that suppressor adjacent that link with vodases disabled when connection to that link is made, and further means for disconnecting transmitting echo suppressors more remote from the vodas link.

8. The combination of claim 7 characterized by the fact that the remote suppressors are disconnected by electric impulses transmitted from a point adjacent the vodas terminal.

9. The combination of claim 7 characterized by the fact that the suppressor adjacent the link with vodases is enabled by a circuit connection through the sleeve of the switching connection at that point and that the remote suppressors are disconnected by a tone transmitted from the vodas switching point.

10. In a communication system, a plurality of four-wire links and a two-wire link adapted to be connected in series with one or more of the four-wire links at one end, means for preventing echoes comprising echo suppressors supplied to each four-wire link, the suppressors being normally disconnected, means for connecting in the suppressors at a switching point and maintaining such connection if the circuit does not include the two-wire link, and further means for disconnecting the suppressors in the four-wire links when the two wire link is included in the circuit.

11. The combination of claim 10 characterized by the fact that the suppressors in the four-wire links are restored to connection when the two-wire link is removed.

12. In a communication system including a four-wire link to be connected in series with other links and supplied with echo suppressors nor-

mally disconnected, means for connecting echo suppressors when the link is connected to other links of the same character, means for disabling the suppressor at the remote end of this link
 5 when connections are made at the near end to a link of a different character, and further means for enabling the suppressor at the remote end when that connection at the near end is broken.

13. In a communication system comprising a
 10 four-wire link with terminals at stations A and B remote from each other, the link being adapted for extension by connection to other links at the two stations, echo suppressors supplied to the link and means at B responsive to incoming sig-
 15 nals from A to disable the echo suppressor at B at the beginning of a connection established at A and responsive to incoming signals at the termination of the connection at A to again restore the connection of the echo suppressor.

20 14. In a communication system, a plurality of four-wire links and a two-wire link adapted to be connected in series with the four-wire links at one end, means for preventing echoes comprising echo suppressors supplied to the four-wire
 25 links, the suppressors being normally disconnected, means for connecting the suppressors at a switching point and maintaining such connection if the circuit does not include the two-wire link, and further means for disconnecting the con-
 30 nected suppressors in one of the four-wire links when the two-wire link is included in the circuit.

15. In a communication system including a plurality of four-wire links and a two-wire link, means at a switching point for establishing series
 35 connections between said four-wire links and between one of said four-wire links and said two-wire link, normally disconnected echo suppressors for each four-wire link, means for connecting in the suppressors at the switching point and for
 40 maintaining such connection when a series connection is established between said four-wire links, and means, when a series connection is established between one of said four-wire links and said two-wire link, for preventing the connection
 45 of suppressors in the four-wire link and for disconnecting any such suppressor which is already connected.

16. In a communication system including a
 50 vodas link, a subscriber link and a plurality of four-wire links, means at a switching point for establishing series connections between said four-wire links, between one of said four-wire links and said vodas link and between one of said four-wire links and said subscriber link, normally
 55 disconnected echo suppressors for each four-wire link, means for connecting the echo suppressors at the switching point and for maintaining them connected when a series connection is established between said four-wire links, means, when a series
 60 connection is established between one of said four-wire links and said vodas link, for preventing the connection of suppressors in the four-wire link and for disconnecting any such suppressor

which is connected, and means for preventing the connection of the suppressor in the four-wire link at the switching point when a series connection is established between one of said four-wire links and said subscriber link.

17. In a communication system including a
 5 four-wire link with terminals at stations A and B remote from each other, the link being adapted for extension by connection to other links at the two stations, echo suppressors supplied to the link and means at B responsive to the establishment
 10 of a connection with said link at A for disabling the echo suppressor at B and responsive to the disestablishment of the connection at A to again restore the connection of the echo suppressor.

18. In a communication system, a four-wire link
 15 terminating at stations A and B remote from each other and adapted for extension by connection to other links at the two stations, the link being provided at station A with a plurality of ter-
 20 minals for connection with one or more other links thereat on a two-wire basis and with one or more other links thereat on a four-wire basis, echo suppressors supplied to the link, means at
 25 station A for disconnecting any of said terminals used for connection with other links on a two-wire basis when the link is connected with another link on a four-wire basis, and means at
 30 station B responsive to incoming signals from station A to disable the echo suppressor at station B at the beginning of a connection established at station A and responsive to incoming
 35 signals at the termination of the connection at A to again restore the connection of the echo suppressor.

19. In a communication system, a switching
 40 station, a vodas link, a subscriber link and a plurality of four-wire links terminating thereat, one of said four-wire links being provided at said station with a plurality of terminals for con-
 45 nection of said link with said vodas link on a four-wire basis and for connection of said link with said subscriber link or with the other four-wire links on a two-wire basis, means at said
 50 station operative when said link is connected to any other link on a four-wire basis for disconnecting any of said terminals used for connection with other links on a two-wire basis, normally
 55 disconnected echo suppressors for the four-wire links, means for connecting the echo suppressors at the switching station and maintaining them connected when said four-wire link is connected with any of the other four-wire links, means,
 60 when said four-wire link is connected with said vodas link, for preventing the connection of suppressors in said four-wire link and for disconnecting any such suppressor which is connected, and means for preventing the connection of the suppressor in said four-wire link at the switching station when said link is connected with said subscriber link.

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